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(54) ELECTROSTATIC CHARGE IMAGE DEVELOPING TONER, ITS PRODUCTION AND IMAGE FORMING METHOD

(57)Abstract:

PROBLEM TO BE SOLVED: To obtain an electrostatic charge image developing toner adaptable to requirements for the increase of the resolution of an image, uniform in shape and having a small particle diameter and to stably form a high resolution image using the toner over a long period of time.

SOLUTION: The toner consists essentially of a resin and a colorant, has 3-9 μm volume average particle diameter and an ellipticity represented by the equation (ellipticity)=(minor axis diameter of ellipse)/(major axis diameter of ellipse) in the range of 0.50-0.85 and contains $\geq 60\%$ by number of toner particles whose ellipticity is in the range of 0.60-0.80.

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CLAIMS

[Claim(s)]

[Claim 1] The toner for electrostatic-charge image development with which the volume mean particle diameter of this toner is 3-9 micrometers, and the ratio of the ellipse particle shape is indicated to be with the following relation is within the limits of 0.50-0.85, and the thing of the configuration of the range of 0.60-0.80 is characterized by 60-piece being several % or more in the toner for electrostatic-charge image development which consists of resin and a coloring agent at least.

Ratio =(minor axis of ellipse)/of an ellipse (major axis of an ellipse)

[Claim 2] In the image formation approach of contacting the electrostatic latent image formed on the photo conductor in the developer layer formed on the developer conveyance member, and developing it This developer comes to contain the toner for electrostatic-charge image development which consists of resin and a coloring agent at least. The image formation approach that the volume mean particle diameter of this toner is 3-9 micrometers, and the ratio of the ellipse particle shape is indicated to be with the following relation is within the limits of 0.50-0.85, and the thing of the configuration of the range of 0.60-0.80 is characterized by 60-piece being the toner it is [toner] several % or more.

Ratio =(minor axis of ellipse)/of an ellipse (major axis of an ellipse)

[Claim 3] In the image formation approach of making the electrostatic latent image formed on the photo conductor countering the developer layer formed on the developer conveyance member in the state of non-contact, making only the toner for electrostatic-charge image development flying, and developing This developer comes to contain the toner for electrostatic-charge image development which consists of resin and a coloring agent at least. The image formation approach that the volume mean particle diameter of this toner is 3-9 micrometers, and the ratio of the ellipse particle shape is indicated to be with the following relation is within the limits of 0.50-0.85, and the thing of the configuration of the range of 0.60-0.80 is characterized by 60-piece being the toner it is [toner] several % or more.

Ratio =(minor axis of ellipse)/of an ellipse (major axis of an ellipse)

[Claim 4] the manufacture approach of the toner for electrostatic charge image development that the volume mean particle diameter of this toner be 3-9 micrometers , and the ratio of the ellipse particle shape be indicate to be with the following relation be within the limits of 0.50-0.85 , and the thing of the configuration of the range of 0.60-0.80 be characterize by 60 piece be several % or more in the manufacture approach of the toner for electrostatic charge image development of make a resin particle and a color particle come to meet in a drainage system medium at least .

Ratio =(minor axis of ellipse)/of an ellipse (major axis of an ellipse)

[Claim 5] In the manufacture approach of the toner for electrostatic-charge image development which uses an air-current type dryer after making a resin particle and a color particle meet in a drainage system medium at least The manufacture approach of the toner for electrostatic-charge image development that the volume mean particle diameter of this toner is 3-9 micrometers, and the ratio of the ellipse particle shape is indicated to be with the following relation is within the limits of 0.50-0.85, and the thing of the configuration of the range of 0.60-0.80 is characterized by 60-piece being several % or more.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the toner for electrostatic-charge image development and the image formation approach which are used for a copying machine, a printer, etc.

[0002]

[Description of the Prior Art] In recent years, the electrophotography development method is used in various fields. For example, not only a monochrome copying machine but fields, such as a printer which is the printing terminal of a computer, and a color copying machine, a color printer, are used. The demand to the quality of an image is high as these use progresses.

[0003] For improvement in image quality, there are various proposals which diameter[of a granule]-ize a toner and raise image quality, and there is no ***** in listing. The so-called polymerization method toner is known as a technique corresponding to diameter[of a granule]-izing. The manufacturing method of the polymerization method toner to which it makes it come to join the resin particle shown in JP,63-186253,A etc. especially and a color particle is the technique which can indeterminate-form-size particle shape. However, although indeterminate-form-izing with this technique is possible, it cannot stabilize to distribution of a configuration, but since there is configuration distribution, distribution of electrification nature becomes large, development nature is not stabilized, but an imprint is also further influenced by electrification nature of distribution, and it has the problem to which imprint effectiveness falls.

[0004] Moreover, if particle size distribution is diameter[of a granule]-ized, since the weight of the particle itself becomes small also in the same amount of electrifications, the adhesion force to the carrier of the particle itself will become strong as a result. Therefore, in the toner which has distribution to electrification nature, it is easier to produce a difference from electrification grant members, such as a carrier, to desorption, and development nature is not stabilized as a result, and it becomes easy to produce problems, such as imprint nonuniformity, in an imprint. Furthermore, in the diameter[of a granule]-ized conventional toner, many high toners of Van der Waals force will exist, the electrification grant engine performance falls, and generating of a weak electrification nature toner and generating of a fault electrification toner take place.

[0005] Consequently, in the use over a long period of time, generating of fogging takes place to an image, problems, such as contamination to a development counter or the carrier in 2 component development, are generated, and it has the problem to which endurance falls.

[0006]

[Problem(s) to be Solved by the Invention] As described above, there is a problem of the standup of electrification about the diameter[of a granule]-ized toner. Increasing the specific surface area of a toner particle like JP,9-96919,A, and improving the standup of electrification, in order to solve this problem is examined. Surely by this policy, the standup of electrification becomes quite good. However, even in such a case, with the conventional toner, the homogeneity of a configuration runs short and it has the problem in the stability of development, the stability of an imprint, etc. Therefore, the development for which high resolution is required of fluctuation of the engine performance especially greatly found that the engine performance was still inadequate.

[0007] the configuration where the purpose of this invention suited the demand to high-resolution-izing of an image -- uniform -- moreover -- small -- the particle size toner for electrostatic-charge image development, and the high resolution using this -- stability -- and it is in offering the image formation approach which can be continued and formed at a long period of time.

[0008]

[Means for Solving the Problem] Since the demand to high-resolution-izing of an image is wholeheartedly suited as a result of examination, he artificers not only diameter[of a granule]-ize, but comes to complete a header and this invention for the policy which secures the homogeneity of a configuration.

[0009] The purpose of this invention is attained by taking any of the following configuration they are.

[0010] [1] The toner for electrostatic-charge image development with which the volume mean particle diameter of this toner is 3-9 micrometers, and the ratio of the ellipse particle shape is indicated to be with the following relation is within the limits of 0.50-0.85, and the thing of the configuration of the range of 0.60-0.80 is characterized by 60-piece being several % or more in the toner for electrostatic-charge image development which consists of resin and a coloring agent at least.

[0011]

Ratio =(minor axis of ellipse)/of an ellipse (major axis of an ellipse)

[2] In the image formation approach of contacting the electrostatic latent image formed on the photo conductor in the developer layer formed on the developer conveyance member, and developing it This developer comes to contain the toner for electrostatic-charge image development which consists of resin and a coloring agent at least. The image formation approach that the volume mean particle diameter of this toner is 3-9 micrometers, and the ratio of the ellipse particle shape is indicated to be with the following relation is within the limits of 0.50-0.85, and the thing of the configuration of the range of 0.60-0.80 is characterized by 60-piece being the toner it is [toner] several % or more.

[0012]

Ratio =(minor axis of ellipse)/of an ellipse (major axis of an ellipse)

[3] In the image formation approach of making the electrostatic latent image formed on the photo conductor countering the developer layer formed on the developer conveyance member in the state of non-contact, making only the toner for electrostatic-charge image development flying, and developing This developer comes to contain the toner for electrostatic-charge image development which consists of resin and a coloring agent at least. The image formation approach that the volume mean particle diameter of this toner is 3-9 micrometers, and the ratio of the ellipse particle shape is indicated to be with the following relation is within the limits of 0.50-0.85, and the thing of the configuration of the range of 0.60-0.80 is characterized by 60-piece being the toner it is [toner] several % or more.

[0013]

Ratio =(minor axis of ellipse)/of an ellipse (major axis of an ellipse)

[4] the manufacture approach of the toner for electrostatic charge image development that the volume mean particle diameter of this toner be 3-9 micrometers , and the ratio of the ellipse particle shape be indicate to be with the following relation be within the limits of 0.50-0.85 , and the thing of the configuration of the range of 0.60-0.80 be characterize by 60 piece be several % or more in the manufacture approach of the toner for electrostatic charge image development of make a resin particle and a color particle come to meet in a drainage system medium at least .

[0014]

Ratio =(minor axis of ellipse)/of an ellipse (major axis of an ellipse)

[5] In the manufacture approach of the toner for electrostatic-charge image development which uses an air-current type dryer after making a resin particle and a color particle meet in a drainage system medium at least The manufacture approach of the toner for electrostatic-charge image development that the volume mean particle diameter of this toner is 3-9 micrometers, and the ratio of the ellipse particle shape is indicated to be with the following relation is within the limits of 0.50-0.85, and the thing of the configuration of the range of 0.60-0.80 is characterized by 60-piece being several % or more.

[0015] That is, in this invention, since a configuration can be equalized, the electrification nature at the time of development serves as homogeneity. Consequently, negatives can be faithfully developed to an electrostatic latent image, since the toner with which potential was further stabilized by the imprint exists on a photo conductor, it is efficient, and there is so-called "no HAJIKI", and a faithful image can be formed on a base material.

[0016] The ratio of an ellipse is an index which shows whenever [to the circle which makes an overall diameter a diameter / sufficiency], and shows the degree of the roundness of a toner particle so that clearly from the definition of the ratio of the above-mentioned ellipse. A numeric value becomes small, so that a circular thing becomes close to 1 and it becomes an ellipse (an indeterminate form is also included).

[0017] In this invention, the toner particle which has the ratio of the ellipse of the toner particle defined above within the limits of 0.50-0.85, and has the ratio of an ellipse in the range of 0.60-0.80 is characterized by using 60-piece the toner for electrostatic-charge image development which is several % or more.

[0018] The ratio of this ellipse takes the photograph which expanded the toner particle by 500 times with the scanning electron microscope, and, subsequently analyzes a photograph using "SCANNING IMAGE ANALYSER" (JEOL Co., Ltd. make) based on this photograph. Under the present circumstances, the ratio of the ellipse of this invention is measured in the following formula using 500 toner particles.

[0019]

Ratio =(minor axis of ellipse)/of an ellipse (major axis of an ellipse)

When it contains the particle to which the ratio of an ellipse exceeds 0.85, in order that the configuration of (it is the semantics of containing three or more pieces substantially in 500 pieces here described above as containing), and a toner particle may conglobate, the fluidity as fine particles becomes high and there is an advantage in respect of conveyance nature, development nature, etc. However, at the time of an imprint, it on the contrary becomes easy to generate imprint HAJIKI, and image quality degradation by imprint tends to take place. On the other hand, when the ratio of an ellipse contains less than 0.50 toner particle, indeterminate form-ization becomes high and the fall of development nature occurs. Moreover, since the rate of an abundance ratio of the particle from which a configuration differs that the toner which has the ratio of an ellipse in the range of 0.60-0.80 is less than several 60% is expanded, distribution of the amount of electrifications etc. has a bad influence in an imprint etc. as breadth and a result, and cannot improve image quality. In addition, what has the ratio of an ellipse in the range of 0.60-0.80 in this invention is desirable, and it is more preferably good that it is [90 piece] several % or more several 80% or more.

[0020] Although not limited especially concerning the manufacture approach for obtaining the toner of this invention, the approach of preparing by the so-called polymerization method can use it preferably.

[0021] namely, extent which is preparing for example, by the polymerization method for stabilization of a configuration -- the configuration of a toner particle can be further equalized by making a uniform configuration form and drying in the state of a flow further at the time of desiccation.

[0022] As a polymerization method, toner constituents, such as a coloring agent and a release agent, are distributed in the polymerization nature monomer for preparing resin. Subsequently, the suspension-polymerization method for carrying out the polymerization of the suspension particle, and obtaining a toner, after suspending underwater, and the so-called emulsification meeting type which prepares a resin particle by the emulsion polymerization, and mix the resin particle and dispersion liquid of toner constituents, such as a coloring agent, and a particle is made to unite, and is prepared of any are sufficient.

[0023] An emulsification meeting mold is general more suitable. By the suspension-polymerization method, since the configuration of a particle becomes a globular form, processes, such as grinding, may be needed after that and the problem that the homogeneity of a configuration is spoiled by the impulse force in that case may occur.

[0024] In order to obtain the configuration of this invention, the so-called thing with a configuration have indeterminate-form-ized and uniform and is desirable as a configuration. In case the particle prepared especially by the polymerization method is dried, the configuration of this invention can be better attained by adopting the approach of carrying out stoving of the particle in an air current.

[0025] Although there is nothing if this reason is clear, form status change-ization occurs by carrying out stoving in an air current, after moisture has existed superfluously, and the part swollen with moisture in the microscopic small field being heated, and that from which the configuration becomes homogeneity as a result is presumed. When performing this heating, it is desirable to perform heat-treatment among an air current in a decreasing drying phase.

[0026] In this case, it is more desirable that water exists 10% of the weight or more to a polymerization particle. Also in order not to become the high temperature which may produce problems, like change takes place to that a configuration will conglobate if the particle itself becomes high temperature, and a surface presentation, and the particle itself softens in order to perform heating in an air current as this reason, it is desirable to use what contains moisture 10% of the weight or more. By this approach, it does not go up even to the temperature which the particle itself softens, and the conglobation of a configuration itself is not promoted.

[0027] In addition, although there is nothing what is limited especially as an upper limit of a moisture content, it is 50 % of the weight. When water exists too much from the amount of this amount, transfer of heat may be insufficient and it may become difficult to equalize a configuration.

[0028] As an example of the air-current dryer which can be preferably used by this invention, there are the so-called spray dry equipment, an oscillating fluidized-bed-drying machine, a high-speed fluidized-drying machine, a flash plate jet dryer, etc. In this case, as temperature of an air current, 30-200 degrees C is good.

[0029] Hereafter, it explains further including a related technique per this invention.

[0030] 1. Although the toner of this invention for electrostatic-charge development of this invention contains resin and a coloring agent at least, a release agent, an electric charge control agent, etc. which are a fixable amelioration agent can also be contained if needed. Furthermore, the external additive which consists of a non-subtlety particle, an organic particle, etc. to the toner particle (this may be called coloring particle) which uses the above-mentioned resin and a coloring agent as a principal component may be added.

[0031] Although the toner of this invention is not limited as described above especially, it can carry out the emulsion polymerization of the monomer in the liquid which added the emulsified liquid of a required additive, for example, can manufacture the polymer particle of a particle, and can manufacture it by the approach of adding an organic solvent, a flocculant, etc. and meeting after that. The approach of being mixed with dispersion liquid, such as a release agent required for the configuration of a toner and a coloring agent, making meet in the case of a meeting, and preparing, the approach of carrying out an emulsion polymerization, after distributing toner constituents, such as a release agent and a coloring agent, in a monomer, etc. are raised. In addition, a meeting shows that two or more resin particles and color particles weld here.

[0032] Furthermore, since it is necessary to indeterminate-form-ize a configuration in that case, after giving and indeterminate-form-izing mechanical impulse force to a polymerization particle, it is required, although it can also prepare by the suspension-polymerization method to control a configuration.

[0033] Although there is no method of manufacturing the toner of this invention especially at the thing limited as mentioned above, its approach of carrying out afterbaking processing of having made the particle forming by the approach suitably shown in JP,5-265252,A, JP,6-329947,A, and JP,9-15904,A is desirable. That is, after distributing these using an emulsifier in the method of making the particle which consists of resin, a coloring agent, etc. meet more than plurality, especially underwater, while adding and carrying out the salting-out of the flocculant more than critical condensation concentration, the toner of this invention can be formed by carrying out heating welding above the glass transition point temperature of the formed polymer itself, and carrying out stoving of the particle in the state of a flow with a moisture state. In addition, in here, the organic solvent which carries out the infinity dissolution to water may be added to a flocculant and coincidence.

[0034] What is specifically used as a monomer which constitutes resin Styrene, o-methyl styrene, m-methyl styrene, p-methyl styrene, Alpha methyl styrene, p-chloro styrene, 3, 4-dichloro styrene, p-phenyl styrene, p-ethyl styrene, 2, 4-dimethyl styrene, p-t-butyl styrene, p-n-hexyl styrene, p-n-octyl styrene, The styrene or the styrene derivative like p-n-nonyl styrene, p-n-DESHIRU styrene, and p-n-dodecyl styrene, A methyl methacrylate, ethyl methacrylate, n-butyl methacrylate, Methacrylic-acid isopropyl, methacrylic-acid isobutyl, t-butyl methacrylate, N-octyl methacrylate, 2-ethylhexyl methacrylate, stearyl methacrylate, Methacrylic-acid lauryl, methacrylic-acid phenyl, diethylaminoethyl methacrylate, Methacrylic ester derivatives, such as dimethylaminoethyl methacrylate, A methyl acrylate, an ethyl acrylate, acrylic-acid isopropyl, acrylic-acid n-butyl, Acrylic-acid t-butyl, isobutyl acrylate, acrylic-acid n-octyl, 2-ethylhexyl acrylate, acrylic-acid stearyl, acrylic-acid lauryl, Acrylic ester derivatives, such as acrylic-acid phenyl, ethylene, a propylene, Olefins, such as an isobutylene, a vinyl chloride, a vinylidene chloride, vinyl bromide, Halogen system vinyl, such as vinyl fluoride and vinylidene fluoride, propionic-acid vinyl, Vinyl ester, such as vinyl acetate and BENZOE acid vinyl, vinyl methyl ether, Vinyl ether, such as vinyl ethyl ether, a vinyl methyl ketone, Vinyl ketones, such as a vinyl ethyl ketone and a vinyl hexyl ketone, N-vinylcarbazole, There are an acrylic acid or methacrylic-acid derivatives, such as vinyl compounds, such as N-vinyl compounds, such as N-vinyl indole and N-vinyl pyrrolidone, vinyl naphthalene, and vinylpyridine, acrylonitrile, a methacrylonitrile, and acrylamide. these vinyl system monomer is independent -- or it can be combined and used.

[0035] Moreover, it is still more desirable to use combining what has an ionicity dissociable group as a monomer which constitutes resin. For example, it has substituents, such as a carboxyl group, a sulfonic acid group, and a phosphoric-acid radical, as a configuration radical of a monomer, and, specifically, an acrylic acid, a methacrylic acid, a maleic acid, an itaconic acid, a cinnamic acid, boletic acid, maleic-acid monoalkyl ester, itaconic-acid monoalkyl ester, styrene sulfonic acid, an allyl compound sulfo succinic acid, 2-acrylamide-isobutane sulfonic acid, acid phosphoxyethyl metacrylate, 3-chloro-2-acid phosphoxy propylmetacrylate, etc. are raised.

[0036] Furthermore, it can also consider as the resin of the structure of cross linkage using polyfunctional vinyl,

such as a divinylbenzene, ethylene glycol dimethacrylate, ethylene glycol diacrylate, diethylene-glycol dimethacrylate, diethylene glycol diacrylate, triethylene glycol dimethacrylate, triethylene glycol diacrylate, neopentyl glycol dimethacrylate, and neopentyl glycol diacrylate.

[0037] The polymerization of these monomers can be carried out using a radical polymerization initiator. In this case, an oil solubility polymerization initiator can be used by the suspension-polymerization method. As this oil solubility polymerization initiator, azo-isobutyro-dinitrile, lauryl peroxide, benzoyl peroxide, etc. can be used. Moreover, when using an emulsion-polymerization method, a water-soluble radical polymerization initiator can be used. As a water-soluble polymerization initiator, persulfate, such as potassium persulfate and ammonium persulfate, azobis AMINOJI propane acetate, an azobis cyano valeric acid and its salt, a hydrogen peroxide, etc. can be mentioned.

[0038] As resin which was excellent in this invention, that whose glass transition point is 20-90 degrees C is desirable, and that whose softening temperature is 80-220 degrees C desirable. A glass transition point is measured by the differential calorimetric analysis approach, and softening temperature can be measured with a quantity-sized type flow tester. Furthermore, the thing of 2000-1 million has the molecular weight desirable at 1000-100000, and weight average molecular weight (Mw) measured by gel permeation chromatography as these resin in number average molecular weight (Mn). Furthermore, the thing of 1.5-100, especially 1.8-70 has desirable Mw/Mn as molecular weight distribution.

[0039] Although there is nothing what is limited especially as a flocculant used, what is chosen from a metal salt is used suitably. The salt of trivalent metals, such as a salt of the metal of bivalence, such as a metal salt of alkaline earths, such as calcium and magnesium, manganese, and copper, iron, and aluminum, etc. is raised as the salt of alkali metal, such as sodium, a potassium, and a lithium, and a metal of bivalence as a metal of monovalence, and, specifically, a sodium chloride, potassium chloride, a lithium chloride, a calcium chloride, a zinc chloride, a copper sulfate, magnesium sulfate, a manganese sulfate, etc. can be mentioned as a concrete salt. These may combine and use it.

[0040] As for these flocculants, adding more than critical condensation concentration is desirable. This critical condensation concentration is an index about the stability of an aqueous distribution object, and shows the concentration which adds a flocculant and condensation generates. This critical condensation concentration changes with the components and the dispersants itself which was emulsified a lot. For example, it is described by work "the volume for polymer-chemistry 17,601 (1960) Japan Society of Polymer Science, Japan" besides Seizo Okamura etc., and can ask for detailed critical condensation concentration. Moreover, concentration ***** addition of the salt of the request to the particle dispersion liquid made into the purpose can be carried out as another technique, zeta (zero-energy thermonucleus apparatus) potential of those dispersion liquid can be measured, and it can also ask for the salt concentration from which this value changes as critical condensation concentration.

[0041] Although the addition of the flocculant of this invention should just be more than critical condensation concentration, it is preferably good for critical condensation concentration to add 1.5 or more times still more preferably 1.2 or more times.

[0042] The solvent which carries out the infinity dissolution to the solvent which carries out the infinity dissolution, i.e., water, is shown, and that in which the resin with which this solvent was formed in this invention is not dissolved is chosen. Specifically, ether, such as nitril, such as alcohols, such as a methanol, ethanol, propanol, isopropanol, t-butanol, methoxy ethanol, and butoxy ethanol, and an acetonitrile, and dioxane, can be raised. Especially, ethanol, propanol, and isopropyl alcohol are desirable.

[0043] The addition of this solvent that carries out the infinity dissolution has desirable 1 - 300 volume % to the polymer content dispersion liquid which added the flocculant.

[0044] In addition, although it is desirable to carry out fluidized drying of the slurry in which 10% of the weight or more of water existed to the particle after preparing and filtering a coloring particle in order to make a configuration equalize, what has a polar group especially in a polymer is desirable in this case. In order to demonstrate the effectiveness that the water which exists as this reason to the polymer with which the polar group exists swells some, it is thought that especially equalization of a configuration is easy to attain.

[0045] As a coloring agent used for the toner of this invention, carbon black, the magnetic substance, a color, a pigment, etc. can be used for arbitration, and channel black, furnace black, acetylene black, thermal-black lamp black, etc. are used as carbon black. The alloy of the class called Heusler alloys, such as the alloy in which ferromagnetism is shown, for example, manganese-copper-aluminum, and manganese-copper-tin, a chromium dioxide, etc. can be used by heat-treating, although the compound of ferromagnetic metals, such as an alloy

which contains ferromagnetic metals, such as iron, nickel, and cobalt, and these metals as the magnetic substance, a ferrite, and magnetite, and a ferromagnetic metal are not included.

[0046] As a color the ** C.I. solven tread 1 -- said -- 49 -- said -- 52 -- said -- 58 -- said -- 63 -- said -- 111 -- said -- 122 and the C.I. solvent yellow 19 -- said -- 44 -- said -- 77 -- said -- 79 -- said -- 81 -- said -- 82 -- said -- 93 -- said -- 98 -- said -- 103 -- said -- 104 -- said -- 112 -- said -- 162 and the C.I. solvent blue 25 -- said -- 36 -- said -- 60 -- said -- 70 -- said -- 93 and these 95 grades can be used and such mixture can also be used. As a pigment The ** C.I. pigment red 5, said 48 : 1, said 53 : 1, said 57 : 1 -- said -- 122 -- said -- 139 -- said -- 144 -- said -- 149 -- said -- 166 -- said -- 177 -- said -- 178 -- said -- 222 and C.I. pigment Orange 31 -- said -- 43 and the C.I. pigment yellow 14 -- said -- 17 -- said -- 93 -- said -- 94 -- said -- 138 and C.I. pigment Green 7 -- C. I. pigment blue 15:3 and these 60 grades can be used, and such mixture can also be used. Although the diameter of a number average primary particle is various by the class, about 10-200nm is desirable in general.

[0047] The approach of adding in the phase of making the polymer particle prepared by the emulsion-polymerization method condensing by adding a flocculant as the addition approach of a coloring agent, and coloring a polymer, the approach of adding and carrying out the polymerization of the coloring agent in the phase of carrying out the polymerization of the monomer, and making it into a coloring particle, etc. can be used. In addition, when adding in the phase of preparing a polymer, the thing of a coloring agent which do not check radical polymerization nature and for which a front face is processed and used by a coupling agent etc. like is desirable.

[0048] Furthermore, low molecular weight polypropylene (number average molecular weight = 1500-9000), low molecular weight polyethylene, etc. as a fixable amelioration agent may be added.

[0049] Moreover, an azo system metal complex, quarternary ammonium salt, etc. may be used as an electric charge control agent.

[0050] Moreover, external addition of the particle obtained from a viewpoint of fluid grant by carrying out the polymerization of a non-subtlety particle and the organic particle may be carried out at a toner particle (coloring particle). In this case, use of a non-subtlety particle is desirable, use of inorganic oxide particles, such as a silica, a titania, and an alumina, is desirable, and, as for these inorganic particle, it is still more desirable that hydrophobing processing is carried out by the silane coupling agent, the titanium coupling agent, etc.

[0051] The particle size of the toner of this invention is a 3-9-micrometer thing in volume mean particle diameter. This particle size is controllable by the presentation of the polymer itself to the concentration of a flocculant, the addition of an organic solvent, and a pan. Moreover, the volume mean diameter of a toner particle (coloring particle) is measured by Coulter counter TA-II or the coal tar multi-sizer.

[0052] Although the case where a nonmagnetic toner is used independently etc. can be considered and all can be suitably used when mixing the toner of this invention with the so-called carrier when making the magnetic substance contain and using it as a 1 component magnetism toner, and using it as a two component developer, it is more desirable to use it as a two component developer used mixing with a carrier in this invention.

[0053] Any of the non-covering carrier which consists of only magnetic material particles, such as iron and a ferrite, as a carrier which constitutes a two component developer, or the resin covering carrier which covered the magnetic material particle front face with resin etc. may be used. The mean particle diameter of this carrier has desirable 20-150 micrometers at volume mean particle diameter. Moreover, although there is nothing what is limited especially as resin for covering, styrene-acrylic resin or silicone resin can be raised, for example.

[0054] 2. It is not limited especially as a development method which can use the toner of image formation approach this invention. It can be used suitable for a contact development method or a non-contact development method. Especially the toner of this invention has high electrification standup nature, and is useful to the non-contact development approach. That is, by the non-contact development approach, change of very small electrification acts on the development itself greatly from change of development electric field being large. However, since electrification standup nature is high, the toner of this invention has little change of electrification, and since it can secure the stable amount of electrifications, it can form the image stabilized also by the non-contact development approach over a long period of time.

[0055] As for especially the thickness of a developer that has the toner of this invention, as development of a contact method, it is desirable in a development field that it is 0.4-5mm 0.1-8mm. Moreover, as for especially the gap of a photo conductor and developer support, it is desirable that it is 0.2-4mm 0.15-7mm.

[0056] Moreover, since the developer layer and photo conductor which were formed on developer support do not contact as a non-contact system development method and this development method is constituted, as for a developer layer, being formed by the thin layer is desirable. This approach makes a 20-500-micrometer

developer layer form in the development field of a developer support front face, and has the gap where the gap of a photo conductor and developer support is larger than this developer layer. This thin layer formation is formed in the magnetic blade which uses the magnetic force, or a developer support front face by the method which presses a developer layer regulation rod. Furthermore, there is also the approach of contacting an urethane blade, a phosphor bronze plate, etc. on a developer support front face, and regulating a developer layer. As thrust of press specification-part material, one to 15 gf/mm is suitable. Since the stress to a developer becomes large [conveyance tends to become unstable, and] when thrust is large on the other hand since restraining force is insufficient when thrust is small, the endurance of a developer tends to fall. The desirable range is three to 10 gf/mm. The gap on developer support and the front face of a photo conductor needs to be larger than a developer layer. Furthermore, when adding development bias on the occasion of development, the method which gives only a dc component may be used and any of a method which impress AC bias are sufficient.

[0057] That whose diameter is 10-40mm as magnitude of developer support is suitable. When a diameter is small, mixing of a developer runs short, it becomes difficult to secure sufficient mixing to perform sufficient electrification grant to a toner, when a diameter is large, the centrifugal force over a developer becomes large, and it is easy to generate the problem of scattering of a toner.

[0058] Hereafter, an example of a non-contact development method is explained using drawing 1.

[0059] Drawing 1 is the schematic diagram of the development section of the non-contact development method which can be used suitable for the image formation approach of this invention, and the two component developer in which a photo conductor and 2 contain developer support and, as for 1, 3 contains the toner of this invention, and 4 are power sources for a development field and 6 to form a developer layer and for 7 form an alternating electric field, as for developer layer specification-part material and 5.

[0060] The two component developer containing the toner of this invention is supported by magnetic force on the developer support 2 which has magnet 2B in the interior, and is conveyed to the development field 5 by migration of development sleeve 2A. On the occasion of this conveyance, that thickness is regulated so that the developer layer 6 may not contact a photo conductor 1 in the development field 5 by the developer layer specification-part material 4.

[0061] The least interval (Dsd) of the development field 5 is larger than the thickness (preferably 20-500 micrometers) of the developer layer 6 conveyed to the field, for example, is about 100-1000 micrometers. The power source 7 for forming an alternating electric field has the desirable alternating current of the frequency of 1-10kHz, an electrical potential difference 1 - 3 kVp-p. You may be the configuration of having added the direct current to the power source 7 at the serial at the alternating current if needed. In that case, as direct current voltage, 300-800V are desirable.

[0062] When applying the toner of this invention to a color picture formation method, methods, such as a method (this is made into a package imprint method and shown in drawing 3) which bundles up and is imprinted to an image base material after developing a multiple-times monochrome image and forming a color picture on the method (this is serially made into an imprint method and shown in drawing 2) serially imprinted to an image base material or a photo conductor, forming a monochromatic image in up to a photo conductor, are held.

[0063] As developer support used in this invention, many things which built the magnet in the interior of support are used, and the thing of aluminum, the aluminum which oxidized the front face, or the product made from stainless steel is used as what constitutes a developer support front face.

[0064] The toner image formed on the photo conductor by the various methods mentioned above is imprinted by imprint material, such as paper, according to an imprint process. It is not limited especially as an imprint method, but various methods, such as so-called corona-transfer method, so-called roller-transfer method, etc., can be adopted.

[0065] After imprinting a toner image to imprint material, the toner which remained on the photo conductor is removed by cleaning, and a photo conductor is repeatedly used for the following process.

[0066] It is not limited, especially concerning the device cleaned in this invention, but well-known cleaning devices, such as a blade cleaning method, a magnetic brush cleaning method, and a fur brush cleaning method, can be used for arbitration. As these cleaning device, a suitable thing is the blade cleaning method which used the so-called cleaning blade.

[0067] As for the suitable fixing approach used for this invention, a hot calender roll fixing method is held.

[0068] In many cases, by this fixing method, it is formed in the interior of the metal cylinder which consists of

iron which covered tetrafluoroethylene and polytetrafluoroethylene-perfluoro alkoxy vinyl ether copolymers on the front face, aluminum, etc. from the upper roller which has a heat source, and the lower roller formed with silicone rubber etc. It is the example of representation which has a linear heater and heats the skin temperature of an upper roller at about 120-200 degrees C as a heat source. In the fixing section, between an upper roller and a lower roller, apply a pressure, a lower roller is made to deform and the so-called nip is formed. As nip width of face, it is 1.5-7mm preferably 1-10mm. Fixing linear velocity has desirable 40 mm/sec - 400 mm/sec. When nip is narrow, it becomes impossible to give heat at a toner to homogeneity, and the nonuniformity of fixing is generated. On the other hand, when nip width of face is wide, melting of resin is promoted, and the problem from which fixing offset becomes excessive is generated.

[0069] You may use it, giving the device of fixing cleaning. The approach of cleaning the method which supplies silicone oil to the upper roller or film of fixing as this method, and silicone oil by the pad which sank in, the roller, Webb, etc. can be used.

[0070]

[Example] Next, although an example explains the mode of this invention further, this invention is not limited to this.

[0071] 1. After adding production styrene 98.1g [of a polymer slurry], n-butyl acrylate 18.4g, 6.1g [of methacrylic acids], and t-dodecyl mercaptan 3.3g, and 850ml of degassing finishing pure water, the temperature up was carried out to 80 degrees C, performing stirring under a nitrogen air current. Subsequently, added 200ml of pure water which dissolved 4.1g of potassium persulfate, it was made to react at 80 degrees C for 6 hours, and polymer particle dispersion liquid were prepared. Let this be "polymer particle dispersion liquid 1."

[0072] Solid content concentration which made low molecular weight polypropylene (number average molecular weight = 3200) emulsify underwater with a surfactant, applying heat = 20% of the weight of emulsification dispersion liquid were prepared. At the room temperature, 43g of these low-molecular-weight-polypropylene emulsification dispersion liquid was added above "polymer dispersion liquid 1", 100ml (carbon black concentration = 10 % of the weight) of dispersion liquid which distributed carbon black with the surface active agent further was added, and dispersion liquid were prepared.

[0073] 160ml of 2.7-mol % potassium chloride water-solutions was added to 600ml of these dispersion liquid, and 40ml of pure water which dissolved isopropyl alcohol 94ml and polyoxyethylene octyl phenyl ether (ethyleneoxide average degree of polymerization is 10) 5.4g further was added. Then, the temperature up was carried out and it was made to react to 85 degrees C for 6 hours. Subsequently, it rinsed by filtering reaction mixture after reaction termination. Let this thing be "the polymer slurry 1." The moisture content measured by the loss-on-drying method of this thing was 38 % of the weight.

[0074] Furthermore, the polymer slurry (polymer slurries 2-4) from which filtration conditions are changed and a moisture content differs was prepared. Moreover, meeting conditions were changed and the polymer slurry (polymer slurries 5-8) to which the configuration was changed was prepared.

[0075]

[Table 1]

重合体番号	水分
重合体スラリー 1	37 重量%
重合体スラリー 2	21 重量%
重合体スラリー 3	46 重量%
重合体スラリー 4	76 重量%
重合体スラリー 5	41 重量%
重合体スラリー 6	40 重量%
重合体スラリー 7	39 重量%
重合体スラリー 8	37 重量%

[0076] Subsequently, the slurry was dried using the fluidized-bed-drying machine. Desiccation conditions are shown in the following table.

[0077] Supply air temperature shows the temperature of the air supplied in order to make a particle float to a fluidized-bed-drying machine, and outlet air temperature is an air temperature discharged, and it shows the temperature at the time of desiccation termination.

[0078]

[Table 2]

重合体番号	ス ラ リ ー	供給空気温度	出口空気温度
重合体 1	重合体スラリー 1	65℃	55℃
重合体 2	重合体スラリー 2	65℃	55℃
重合体 3	重合体スラリー 3	65℃	55℃
重合体 4	重合体スラリー 4	65℃	55℃
重合体 5	重合体スラリー 1	80℃	80℃
重合体 6	重合体スラリー 5	65℃	55℃
重合体 7	重合体スラリー 6	65℃	55℃
重合体 8	重合体スラリー 8	65℃	55℃

[0079] Furthermore, it asked for the ratio of the ellipse of a polymer. The ratio of an ellipse takes a 500 times as many photograph as this with a scanning electron microscope, and computes the ratio of an ellipse by SIA about 500 particles based on the photograph.

[0080]

[Table 3]

重合体番号	楕円の比率	楕円の比率が 0.60~0.8 の粒子比率	体積平均粒径 (μm)	備 考
重合体 1	0.61~0.72	100 個数%	6.9	本発明用
重合体 2	0.57~0.81	87 個数%	6.7	本発明用
重合体 3	0.56~0.82	83 個数%	6.8	本発明用
重合体 4	0.54~0.83	78 個数%	7.2	本発明用
重合体 5	0.71~0.89	45 個数%	6.5	比較用
重合体 6	0.45~0.72	62 個数%	6.3	比較用
重合体 7	0.56~0.75	83 個数%	6.9	本発明用
重合体 8	0.61~0.82	93 個数%	6.8	本発明用

[0081] The above "a polymer 1" The hydrophobic silica (primary number average particle diameter = 12nm) was added 1% of the weight to - "a polymer 8", and the toner was obtained. These are made into "toner 1" - "a toner 8." [0082] Evaluation (non-contact development method)

Evaluation mixed the above-mentioned toner with the ferrite carrier whose volume mean particle diameter covered with styrene-acrylic resin is 50 micrometers, and prepared and used the developer whose toner concentration is 7 % of the weight. In addition, the developer corresponding to above-mentioned "a toner 1" - "a toner 8" is made into "developer 1" - "a developer 8."

[0083] Evaluation is digital color copying machine Konica by Konica Corp. It was used having converted 9028. Conditions are conditions shown below. The laminating mold organic photo conductor was used as a photo conductor.

[0084]

Photo conductor surface potential = -550VDC bias = -250VAC bias =****-p:-50 - -450V alternating electric field frequency = [1800HzDsd] = 300-micrometer press restraining force = 10 gf/mm press regulation rod = SUS416 (product made from magnetic stainless steel) / diameter developer thickness of 3mm 20mm The diameter of a = 150micrometer development sleeve = in addition The configuration of a fixing assembly has iron of the shape of a cylinder which built the heater with a diameter of 30mm which covered the front face with the tetrafluoroethylene-perfluoroalkyl vinyl ether copolymer in the center section as an upper roller. It has the lower roller with a diameter of 30mm which consisted of silicone rubber which the front face covered with the tetrafluoroethylene-perfluoro alkyl ether copolymer similarly. The linear pressure was set as 0.8 kg/cm and width of face of nip was set to 4.3mm. This fixing assembly was used and the linear velocity of printing was set as 90 mm/sec. In addition, it was used, having equipped with the pad which sank in fluorine system silicone oil as a cleaning device of a fixing assembly. Moreover, skin temperature of a fixing assembly was made into 180 degrees C.

[0085] As a transfer paper to be used, the ream weight used the form which is 55kg, and formed the image in the lengthwise direction. Moreover, as image formation conditions, it carried out in the ordinary temperature normal-relative-humidity environment (25 degrees C / 55%RH). As evaluation criteria, the sharp nature of the image by the repeatability of a thin line was evaluated. The number of a thin line reproducible to per mm

estimates this evaluation, and it was evaluated about both the thin line of a lengthwise direction, and the lateral thin line to the conveyance direction of a transfer paper. The 10 times as many magnifier as this compared the image in fact, and the maximum number per mm which can be distinguished in the condition of having been continuously formed without the line's being intermittent was measured.

[0086] Furthermore, printing of 100,000 sheets was continuously carried out in the ordinary temperature normal-relative-humidity environment using the image of the rate of a pixel 5%, and same evaluation was carried out also about the image after 100,000-sheet printing.

[0087] A result is shown below.

[0088]

[Table 4]

現像剤番号	細線本数 (初期)		細線本数 (10 万枚後)		備 考
	縦方向	横方向	縦方向	横方向	
現像剤 1	7. 0本	7. 0本	7. 0本	6. 5本	本発明用
現像剤 2	7. 0本	6. 5本	6. 5本	6. 5本	本発明用
現像剤 3	6. 5本	6. 5本	6. 0本	6. 0本	本発明用
現像剤 4	6. 0本	6. 0本	6. 0本	5. 5本	本発明用
現像剤 5	4. 5本	3. 5本	3. 5本	3. 0本	比較用
現像剤 6	4. 5本	4. 0本	3. 5本	3. 0本	比較用
現像剤 7	6. 5本	6. 0本	6. 0本	5. 5本	本発明用
現像剤 8	7. 0本	7. 0本	7. 0本	6. 5本	本発明用

[0089] It turns out that the thing of this invention is excellent in resolution so that clearly from Table 4.

[0090] Evaluation (contact development method)

Then, evaluation by the contact development method was carried out. Evaluation mixed the above-mentioned toner with the ferrite carrier whose volume mean particle diameter covered with styrene-acrylic resin is 65 micrometers, and prepared and used the developer whose toner concentration is 5 % of the weight. In addition, the developer corresponding to above-mentioned "a toner 1" - "a toner 8" is made into "developer 9" - "a developer 16."

[0091] Evaluation is digital color copying machine Konica by Konica Corp. It was used having converted 9028. Conditions are conditions shown below. The laminating mold organic photo conductor was used as a photo conductor.

[0092]

Photo conductor surface potential = -700VDC bias = -500VDsd = 600-micrometer developer layer regulation = magnetism H-Cut method developer thickness In addition, 40mm The diameter of =700-micrometer development sleeve = the configuration of a fixing assembly It has iron of the shape of a cylinder which built the heater with a diameter of 30mm which covered the front face with the tetrafluoroethylene-perfluoroalkyl vinyl ether copolymer in the center section as an upper roller. It has the lower roller with a diameter of 30mm which consisted of silicone rubber which the front face covered with the tetrafluoroethylene-perfluoro alkyl ether copolymer similarly. The linear pressure was set as 0.8 kg/cm and width of face of nip was set to 4.3mm. This fixing assembly was used and the linear velocity of printing was set as 90 mm/sec. In addition, it was used, having equipped with the pad which sank in silicone oil as a cleaning device of a fixing assembly. Moreover, skin temperature of a fixing assembly was made into 180 degrees C.

[0093] As a transfer paper to be used, the ream weight used the form which is 55kg, and formed the image in the lengthwise direction. Moreover, as image formation conditions, it carried out in the ordinary temperature normal-relative-humidity environment (25 degrees C / 55%RH). As evaluation criteria, the sharp nature of the image by the repeatability of a thin line was evaluated. The number of a thin line reproducible to per mm estimates this evaluation, and it was evaluated about both the thin line of a lengthwise direction, and the lateral thin line to the conveyance direction of a transfer paper. The 10 times as many magnifier as this compared the image in fact, and the maximum number per mm which can be distinguished in the condition of having been continuously formed without the line's being intermittent was measured.

[0094] Furthermore, printing of 100,000 sheets was continuously carried out in the ordinary temperature normal-relative-humidity environment using the image of the rate of a pixel 5%, and same evaluation was carried out also about the image after 100,000-sheet printing.

[0095] A result is shown below.

[0096]

[Table 5]

現像剤番号	細線本数(初期)		細線本数(10万枚後)		備 考
	縦方向	横方向	縦方向	横方向	
現像剤 9	6.5本	6.5本	6.5本	6.5本	本発明用
現像剤 10	6.5本	6.0本	6.5本	6.0本	本発明用
現像剤 11	6.0本	6.0本	6.0本	5.5本	本発明用
現像剤 12	5.5本	5.5本	5.5本	5.5本	本発明用
現像剤 13	4.0本	3.5本	3.5本	3.0本	比較用
現像剤 14	4.0本	4.0本	3.5本	3.5本	比較用
現像剤 15	6.5本	6.0本	6.5本	6.0本	本発明用
現像剤 16	6.5本	6.5本	6.5本	6.5本	本発明用

[0097] It turns out that the thing of this invention is excellent in resolution also in a contact development method so that clearly from Table 5.

[0098]

[Effect of the Invention] the configuration which suited the demand to high-resolution-izing of an image by this invention -- uniform -- moreover -- small -- the particle size toner for electrostatic-charge image development, and the high resolution using this -- stability -- and the image formation approach which can be continued and formed at a long period of time can be offered.

[Translation done.]